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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

PURCHASE DESCRIPTION

NEXT GENERATION AIR/GROUND COMMUNICATIONS (NEXCOM) MINIMUM THRESHOLD DOCUMENT (MTD) FOR THE ENGINEERING DESIGN MODEL (EDM)

The NEXCOM Integrated Product Team, AND-360

RECORD OF CHANGES

Revision	Date	Action
0.0	4/6/2002	MTD 4/5/02 Draft Baselined as Revision 0.0

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1.0 INTRODUCTION

This Minimum Threshold Document (MTD) identifies the Minimum Threshold Requirements (MTRs) for the NEXCOM System Engineering Design Model (EDM), for the Rapid Preliminary Development Effort (RPDE).

1.1 Background

The International Civil Aviation Organization (ICAO) and RTCA, Inc., carried out a comprehensive analysis of the 118 to 137 MHz frequency range, which is used for aviation Air-Ground (A/G) radio communications. Spectrum was found to be short in supply and the efficiency of use of this band needs to be increased in order to avoid running out of frequency allocations between the years 2005 and 2010. The VHF Digital Link Mode 3 (VDL Mode 3) system was recommended as the future A/G Communication System.

The FAA made a decision to implement the Next Generation A/G Communications (NEXCOM) System based upon VDL Mode 3 technology. VDL Mode 3 uses a Time-Division Multiple Access (TDMA) approach to place three or four digital circuits into one 25-kHz frequency assignment. The digital circuits are independent and can be used for voice and data transmission in accordance with the selected VDL Mode 3 system configuration.

NEXCOM focuses on the ground system aspects of the future A/G communications. Figure 1-1 shows a top-level illustration of the NEXCOM System.

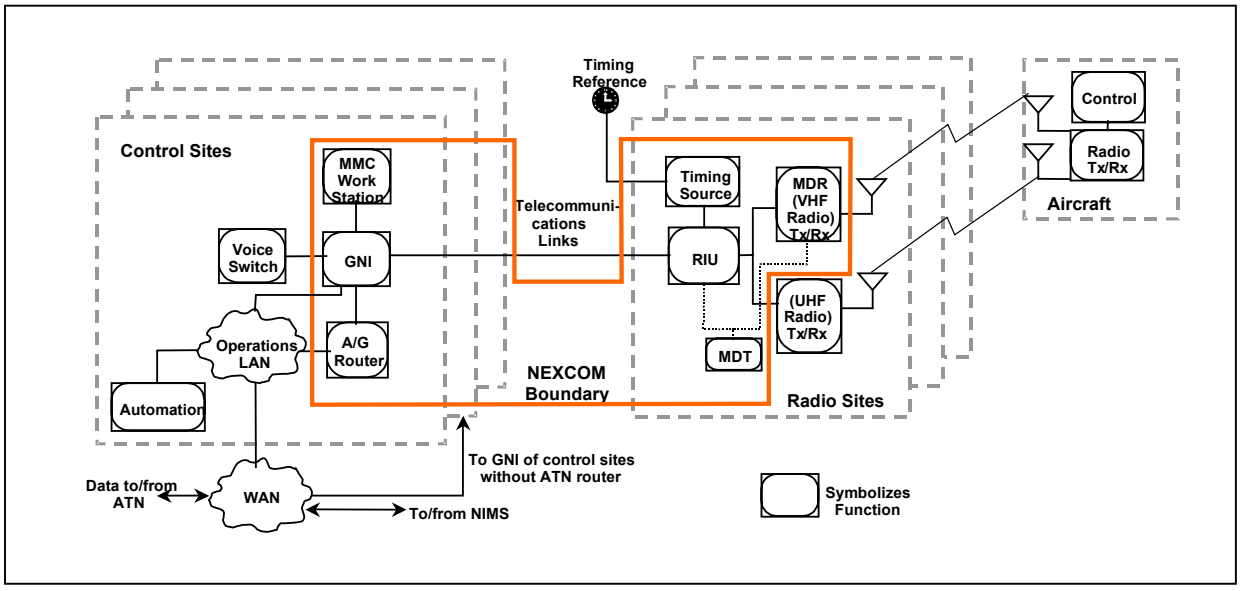

Figure 1-1

Top-Level Illustration of the NEXCOM System

Timely execution of the NEXCOM program is critical to its success. To ensure the overall viability of the NEXCOM program, the FAA is planning to develop a base capability to produce

and implement the NEXCOM system. In order to reduce the risk to the NEXCOM program, the RPDE is introduced. The RPDE consists of the following efforts:

a) Development of a set of Subsystem Specifications (SSS) and Interface Control Documents (ICDs) for the Full Scale Development Program (FSDP)
b) Development of the EDM, through which an initial minimum threshold capability and the expertise to manufacture and implement the NEXCOM System will be demonstrated.

The RPDE will be followed by the FSDP.

1.2 Purpose of the EDM

The purpose of the EDM is to provide an engineering model to demonstrate the following:

a) The technical feasibility of the NEXCOM architecture
b) That the FSDP will be interoperable with the NAS
c) Valid approach as to the major design issues in order to reduce the risks to the NEXCOM FSDP
d) That the FSDP can be deployed in a timely manner and that management can proceed with the FSDP acquisition by August 2004

1.3 Scope

The MTD serves as the procurement document for the EDM. The NEXCOM System Requirements Document (SRD) is the complete set of requirements for the NEXCOM ground system. The requirements stated in this MTD are the subset of the SRD requirements that need to be demonstrated by the EDM. It is recommended that the complete SRD and its appendices be carefully reviewed in order to obtain an in-depth understanding of the NEXCOM System requirements.

Detailed requirements that will be implemented in the EDM are presented in Section 3 of this MTD.

1.4 EDM Demonstration Environment

The EDM will be evaluated as part of the source selection process to determine compliance to the MTRs as defined in this document. The demonstration of the EDM will be scheduled and conducted at the William J. Hughes Technical Center (WJHTC), Atlantic City, NJ. The specific location will be identified in the RPDE Screening Information Request/Request for Offer (SIR/RFO).

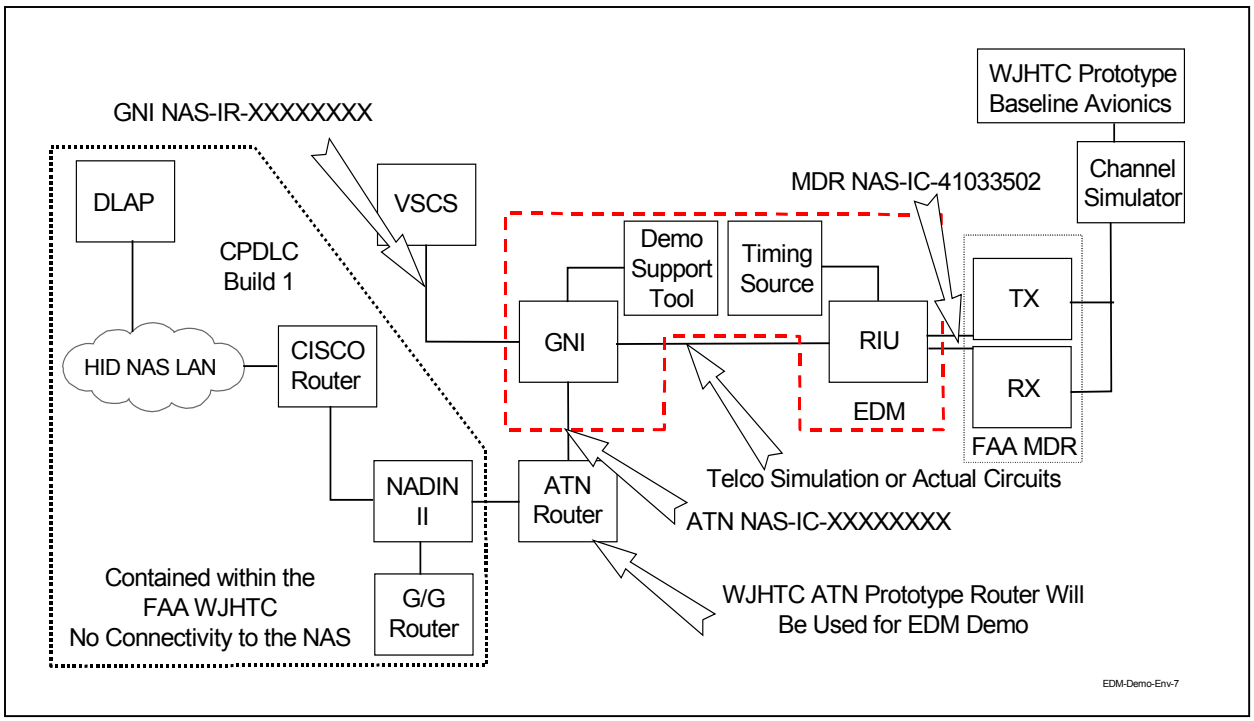

Figure 1-2

Illustration of the EDM Demonstration Environment

Figure 1-2 illustrates the demonstration environment for the EDM. The interfaces between the EDM and the equipment in the demonstration environment are described by a set of interface documents as shown in Figure 1-2 and identified in Section 2 in this MTD. The FAA is providing a Test Environment Description (TED) as part of the RPDE SIR to identify the equipment configuration and other pertinent information needed in order to conduct the demonstration.

The EDM will be evaluated as part of the Offeror's technical submission. In order to conduct the demonstration, the Offeror will provide written demonstration procedures, which will be reviewed and evaluated as part of the technical submission before the conduct of any demonstration.

1.5 Document Organization

Section 1 states the purpose and scope of the MTD. For definitions, the reader needs to refer to Section 1.5 of the SRD.

Section 2 lists the applicable reference documents.

Section 3 lists the MTR for the EDM.

Section 4 summarizes the methods of verification of the requirements given in this MTD.

Section 5 describes any special preparation requirements for delivery.

Section 6 contains applicable notes.

Appendix A provides an overview of the function of the Demonstration Support Tool.

2.0 APPLICABLE DOCUMENTS

The following listed documents form a part of this MTD to the extent specified herein, unless marked "for reference only." In event of a conflict between the documents referenced herein and the contents of this MTD, the contents of this MTD **shall** be considered the superseding requirement.

2.1 Government Documents

2.1.1 FAA Specifications and Interface Documents

Doc. No.	Document Title	Version/Date	Section(s)
FAA-E-2958	Next Generation Air/Ground Communications (NEXCOM) System Requirements Document (SRD)	April 16, 2002, V1.0	
FAA-E-2938	Subsystem Specification, Multimode Digital Radio (MDR)	April 16 2002, V5.0	
ACT330-TED-0002	Next Generation Air/Ground Communications (NEXCOM) William J. Hughes Technical Center Test Environment Description (TED) for the Engineering Design Model (EDM)	April 16, 2002 V0.0	
NAS-IC-42014000	VSCS to the Existing Radio Interface Interface Control Document for the Voice Switching and Control System (VSCS)	April 16, 2002, V0.0	
NAS-IC-64024201	VSCS to Backup Emergency Communications Interface Control Document for the Voice Switching and Control System (VSCS)	April 16, 2002, V0.0	
NAS-IC-41033502	Interface Control Document, Multimode Digital Radio/Radio Interface Unit	July 23 2001, V3.0	
NAS-IR-41044201	Ground Network Interface (GNI) to Voice Switching and Control System (VSCS) Interface Requirements Document for the NEXCOM Engineering Design Model	April 16, 2002, V0.0	
ACT330-ID-0001	INTERFACE DESCRIPTION ATN Air/Ground Router Subnetwork Service Provider to Primary Ground Network Interface Data Port	April 16, 2002, V0.0	

2.1.2 Other FAA Documents

Doc. No.	Document Title	Version/Date	Section(s)
NAS-SS-1000	NAS System Specification, Volume I	December, 1986	3.2.x
FAA-G-2100G	Electrical Equipment, General Requirements	October 22, 2001	

2.2 Non-Government Documents

2.2.1 ICAO Standards

Doc. No.	Document Title	Version/Date	Section(s)
RTCA DO-224A with Change 1	Signal-in-Space Minimum Aviation System Performance Standards (MASPS) for Advanced VHF Digital Data Communications Including Compatibility with Digital Voice Techniques	October 12, 2001	2.0, 3.3, 3.4, 3.5, 3.10, 3.11
ICAO Doc 9705	Manual on the Technical Provisions for the Aeronautical Telecommunications Network (ATN)	Edition 3 / November 2001	
ICAO Annex 10	International Standards and Recommended Practices (SARPs) - Volume III	Amendment 75 / Nov. 2001	Part I, Chapter 6

2.2.2 Industry Standards

Doc. No.	Document Title	Version/Date	Section(s)
Telcordia TR-NWT-000335 (formerly Bellcore)	Voice Grade Special Access Service Transmission Parameter Limits and Interface Combinations	May 1993	Based on FAA Order 6000.22A
Telcordia GR-499-CORE (formerly Bellcore)	Transport Systems Generic Requirements (TSGR) Common Requirements	1998	Based on FAA Order 6000.47C

Doc. No.	Document Title	Version/Date	Section(s)
NFPA Standard 70	National Electrical Code		6.2
Electronic Industries Association (EIA)-310-E	Cabinets, Racks, Panels, and Associated Equipment	March 17, 1999	

2.3 Other Government Documents

Doc. No.	Document Title	Version/Date	Section(s)
FAA Order 3900.19B	Occupational Safety and Health Program	April 29, 1999	
Executive Order 12699	DOT Implementation of Energy Order 12699		
29 CFR, 1910	Occupational Safety And Health Standards	July 1, 1999	
29 CFR, 1926	Safety and Health Regulations for Construction	Various	
47 CFR Part 68	Connection of Terminal Equipment to the Telephone Network		

Note: 47 CFR Part 68 supersedes FAA Orders 1600.66 and 1600.54B.

2.4 Document Sources

2.4.1 FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the NEXCOM Contracting Officer, FAA, 800 Independence Avenue SW, Washington, DC 20591. Requests should clearly identify the desired material by number and state the intended use of the material. FAA-G-2100G may be downloaded from the FAA at http://www.faa.gov/asd/standards/index.htm.

2.4.2 Military and Federal Documents

Single copies of unclassified military and federal specifications, standards, and publications may be obtained by writing the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA, 19120; or by calling (215) 697-3321 Monday through Friday, 8:00 a.m. to 4:30 p.m. Eastern Standard Time (EST).

2.4.3 American National Standards Institute (ANSI) and International Organization of Standardization (ISO) Documents

Copies of American National Standards Institute (ANSI) and International Organization of Standardization (ISO) documents may be obtained from the American National Standards Institute, 11 West 42nd Street, New York, NY, 10036, or through the web site http://www.ansi.org.

2.4.4 International Civil Aviation Organization (ICAO) Documents

Copies of final products of International Civil Aviation Organization (ICAO) documents may be obtained from the ICAO Library is 999 University Street, Montreal, Quebec H3C 5H7, Canada, or through the web site http://www.icao.org.
Note: For current working documents that are not final products, inquire at ICAO web site http://www.icao.org.

2.4.5 RTCA, Inc. Documents

Copies of RTCA, Inc. documents may be obtained from RTCA, Incorporated, 1828 L Street N.W., Suite 805, Washington, DC 20036-4001, by phone (202) 833-9339, or through the web site http://www.rtca.org.

2.5.6 Telcordia Documents

Telcordia (formerly Bellcore) documents may be obtained from the web site http://www.telcordia.com.

2.4.7 Federal Communications Commission Documents

Copies of 47 CFR, Part 2 and Part 87 may be obtained from the FCC, 445 12th Street, SW, Washington D.C. or by downloading from the FCC web site at www.fcc.gov/oet/info/rules.

2.4.8 Electronic Industries Alliance Documents

Copies of Electronic Industries Alliance (EIA) standards may be obtained from the Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834, by calling (703) 907-7500, or through the web site http://www.eia.org.

2.4.9 National Fire Prevention Association (NFPA)

Copies of National Fire Prevention Association materials may be obtained from the NFPA, 1 Batterymarch Park Quincy, MA 02269-9101 USA, Telephone: (617) 770-3000 Fax: (617) 770-0700 or through the web site http://www.nfpa.org.

3.0 REQUIREMENTS

This section contains the MTRs for the EDM in Table 3-1. The section numbers, the section titles, and the requirements are derived from the SRD. The comments define the scope of the requirement appropriate for the EDM implementation. For a description of the current A/G communications system see SRD Appendix A, and for a description of the proposed future A/G communications system see SRD Appendix B.

Table 3-1

MTRs for the EDM

SRD Section	SRD Title	SRD Requirement(s)	Comment(s)
3.2.1.1.1	Site Configurations	a) The NEXCOM System **shall** support the following site configurations:	.
		1. Single Remote Communications Facility (RCF)	.
		3. Primary RCF with backup site (e.g., BUEC)	.
		4. Diversity site group (e.g., multiple RCFs for a User Group)	.
		Note 1: See SRD Section 3.2.3.5 and Appendix A, Section A.3.2.2 for an explanation of diversity site group	.
		Note 2: A local radio installed at a control facility is considered one of the configurations mentioned above.	.
3.2.2	Modes of Operation	a) The NEXCOM System **shall** operate in each of the following selectable modes:	For EDM, demonstrate VDL Mode 3, 2V2D configuration only.
		1. VDL Mode 3	.
3.2.3.1	Voice Communications Requirements	a) The NEXCOM System **shall** allow all users in a Talk Group to monitor all voice communications within that Talk Group.	.
		Note 1: This requirement is fulfilled by the proper implementation of the modes of operation specified in SRD Section 3.2.2.	.
		Note 2: This requirement does not require the rebroadcast of voice traffic when the system is configured to operate for a single sector/control airspace.	.
		b) Data communications, including data communications overloading, **shall** not prevent the operation of voice communication.	.

		c) The NEXCOM System **shall** route received audio to the NEXCOM/VSCE interface based on the received audio at the remote site.	Audio means voice or a digital representation thereof.
		Note 3: If audio is received at the remote site, it should be routed to the corresponding audio port at the VSCE. This configuration is only defined when more than one audio output is utilized at the control site.	.
3.2.3.1.1	Voice Channels	a) The NEXCOM System **shall** interface with existing VSCE (e.g., VSCS, ETVS, ICSS, RDVS, STVS) via existing interfaces (e.g., Single channel VHF + UHF (V+U) and quad channel VHF/UHF/MAIN/STANDBY (V/U/M/S)).	Demonstrate for VSCS Type B (GRIM) and BUEC VHF interfaces only, per NAS-IR-41044210, Ground Network Interface (GNI to Voice Switching and Control (VSCS) Interface Requirements Document for the NEXCOM Engineering Design Model).
3.2.3.1.2	Voice Encoding/Decoding	a) The NEXCOM/VSCE interface **shall** include:	.
		1. Analog voice	.
		b) Voice encoding/decoding for VDL Mode 3 **shall** be in accordance with the vocoder algorithm specified in RTCA DO-224A Section 3.3.5.2.1.	.
3.2.3.1.3.1	Uplink Path	a) The NEXCOM System **shall** transmit uplink voice out of the radio at the site(s) selected by the controller.	.
		Note: The NEXCOM System should not restrict the ability to transmit from multiple sites per sector. However, the VSCS may have restriction based on its design.	.
3.2.3.1.3.2	Downlink Path	a) The NEXCOM System **shall** route all downlink voice output from all selected receivers to the VSCE.	.
		Note: The current system delivers all downlink voice outputs to the VSCE.	.

3.2.3.2.1	Data Service	a) The NEXCOM System **shall** provide for a subnetwork for two-way addressed data communications between ground and Mobile User systems.	.
		b) The NEXCOM System **shall** provide for uplink broadcast using the same subnetwork as the two-way addressed service.	.
		c) The NEXCOM System **shall** provide for uplink data broadcasts that do not depend on any information received over two-way addressed services.	.
		Note: This includes providing an uplink data broadcast subnetwork without supporting two-way service.	.
3.2.3.2.1.1	ATN Compatibility	a) The NEXCOM System **shall** interoperate with ATN-based Air/Ground Routers and avionics routers as defined in the ICAO Annex 10, and ICAO Doc 9705 (Edition 3).	For EDM, interface with router directly per ACT 330-ID-0001.
3.2.3.2.1.3	User Authentication	a) The NEXCOM System **shall** support authentication of user attempts to initialize connections per RTCA DO-224A, Section 3.3.2.3.2.8.	For EDM, digital signature algorithm **shall** comply with FIPS 186-2 (e.g., DSA, RSA, Elliptic Curves). The function **shall** use the SHA-1 hashing algorithm described in FIPS 180-1. This configuration **shall** be communicated using the 'User Defined' field of the Authentication Exchange Identifier of RTCA DO-224A.
3.2.3.4.1	Entry Into a Talk Group	a) The NEXCOM System **shall** allow any Mobile User, operating in the correct mode, entry into any Talk Group within the Talk Group's service volume.	.

		Note: This is to ensure that the Mobile User can enter a Talk Group regardless of whether or not the Mobile User was instructed to do so by the ground controller. For example, in the case where the Mobile User has lost communication with its own Talk Group, it should still be able to access another Talk Group.	.
3.2.3.4.2	Automated Transfer of Communication	a) The NEXCOM System **shall** upload channel assignment information to a Mobile User system via the VDL Mode 3 Next Net capability defined in RTCA DO-224A.	Next Net Messaging will be communicated to the EDM via the vendor-supplied Demo Support tool (DST) (See Appendix A).
		Note: This requirement is intended to support Transfer of Communication (TOC) via Next Net messaging.	.
3.2.3.5	Ground Station Operations	a) The NEXCOM System **shall** support diversity site group(s) operation (see SRD Appendix B for VDL Mode 3).	.
		When operating in VDL Mode 3:	.
		b) The NEXCOM System **shall** schedule the VDL Mode 3 uplink M-Burst of the ground transmitters to avoid self-interference.	Demonstrate how to prevent RCAG/BUEC interference.
		Note 1: One way of avoiding the interference of M-Bursts for the same User Group radiated from different ground sites is to coordinate uplink M-Burst transmissions to allow only one uplink M-Bursts per MAC cycle.	.
		c) In any User Group, the active transmitter **shall** not cause harmful interference with any other User Group operating on the same frequency.	.
		Note 2: This applies to all Main/Standby and BUEC transmitters.	.
3.2.3.6.1	Push-to-Talk Transmitter Keying (PTT/PTT Release)	a) The NEXCOM System voice channel uplink access **shall** be based on PTT assertion.	.

3.2.3.6.2	PTT/PTT Release Confirmation	a) The NEXCOM System **shall** provide confirmation of PTT/PTT Release on a per Talk Group basis.	PTT/PTT release confirmation will be demonstrated by the vendor-supplied DST (See Appendix A).
		Note 1: The activation of the Ground Stuck Microphone Correction function, used to disable NEXCOM RF transmissions, releases the PTT signal and will cause the PTT Confirmation to be de-asserted.	.
3.2.3.6.3	Preemption of Mobile Users' Voice Transmissions (Controller Override)	When operating in VDL Mode 3:	Demonstration needs to include a VSCS workaround for simulation of signaling to activate preemption.
		a) The NEXCOM System **shall** provide a selectable function that allows the controller to preempt Mobile Users' voice transmissions on a per Talk Group basis as follows.	The preemption of the mobile users voice transmissions will be demonstrated via the vendor-supplied DST (See Appendix A).
		1. Preemption Off (function disabled)	.
		2. Preemption On (Upon PTT activation preemption occurs)	.
		3. Momentary Preemption on a single PTT basis (Dynamic function selectable by the controller)	.
		Note 1: This pre-emptive access provides a limited capability to cope with various operational issues including the "stuck" microphone condition by allowing authorized ground users to deactivate the transmitter of the offending Mobile User.	.
		Note 2: The Voice Preemption function (also referred to as controller override) is activated only when the PTT is asserted.	.
		Note 3: In momentary preemption mode, preemption is in effect for a single PTT. Controller selects momentary preemption, presses PTT, and preempts Mobile User voice transmissions one time. When PTT is released, preemption reverts to the "Off" state.	.

3.2.3.6.4	Preemption Confirmation of Mobile Users' Voice Transmissions	a) The NEXCOM System **shall** generate to the NEXCOM/VSCE interface a Voice Preemption Confirmation signal during the assertion of preemption by the ground station.	Preemption Confirmation of mobile users' voice transmissions will be demonstrated using the vendor-supplied DST (See Appendix A).
3.2.3.6.5	Squelch Break	c) In VDL Mode 3, the NEXCOM System **shall** generate to the NEXCOM/VSCE interface a Squelch Break signal based on the detection of a VDL Mode 3 Voice Message using the Squelch Windowing technique described in RTCA DO-224a Section 3.3.5.3.2.	The squelch break will be indicated via the vendor-supplied DST (See Appendix A).
		d) In VDL Mode 3, the NEXCOM System **shall** implement the squelch function based on RTCA DO-224A Section 3.3.5.	.
3.2.3.6.6.1	PTT Mute/Attenuation	*Note: In the requirements below, muting of the received uplink audio is to prevent the controllers from hearing their own ground station transmissions. These requirements are also impacted by Dual Control (SRD Section 3.2.3.6.9 e) and f)).*	.
		For VDL Mode 3 operation:	.
		a) The NEXCOM System **shall** be configurable (on a per Talk Group basis) to mute (at the control site asserting PTT) any received uplink voice bursts attempting to provide audio to the VSCE interface.	Demonstrate VDL Mode 3 only. Show how to prevent hearing own transmissions. This feature will be enabled; configurability need not be demonstrated.
3.2.3.6.7.1	Ground Radio Resource Selection	a) The NEXCOM System **shall** select Ground Radio Resource (e.g., Main/Standby Select/Deselect, or BUEC Select/Reset as necessary) for voice operation based on operator input (e.g. VSCE, MMCWS, and/or MDT).	Demonstrate for RCAG/BUEC selection only; this demonstration is only specific to the VSCS.(No M/S switching)
		b) The NEXCOM System **shall** support independent Ground Radio Resource Selection for voice operation by different Talk Groups.	.
		c) The NEXCOM System **shall** cause no loss of management and user information due to Ground Radio Resource Selection for voice operation.	.

		d) When any PTT is activated, the NEXCOM System **shall** inhibit the Ground Radio Resource Selection for that Talk Group (i.e., inhibit the re-routing of the voice and control signals and inhibit the switching of the antenna transfer relay).	.
3.2.3.6.7.2	Ground Radio Resource Selection Confirmation	The NEXCOM System **shall** provide confirmation of Ground Radio Resource Selection to the operator (e.g. VSCE, MMCWS, and/or MDT) upon completion of radio selection.	Demonstrate for RCAG/BUEC selection only; this demonstration is only specific to the VSCS.
		Note: This requirement has been allocated to all subsystems so that each active subsystem must be informed when any other subsystem makes a change.	.
3.2.3.6.8	Channel Busy Signal	a) The NEXCOM System **shall** provide a Channel Busy signal to the NEXCOM/VSCE interface that indicates the channel keyed by the controller is occupied by a downlink transmission.	The vendor-supplied DST will be used to demonstrate this capability (See Appendix A).
		Note 1: This requirement is needed in support of the voice transmit function of VDL Mode 3 described in RTCA DO-224A Section 3.3.5.4.3.	.
3.2.3.7	Ground Stuck Microphone Correction	a) The NEXCOM System **shall** provide a Ground Stuck Microphone Correction, which can be enabled, that disables the uplink transmission for that Talk Group.	Demonstrate for the VDL Mode 3 through GNI/RIU functionality. The enabling/disabling and setting of time will be demonstrated via the vendor-supplied DST (See Appendix A).
		b) Ground Stuck Microphone Correction **shall** have a configurable time component, so that when the duration of a PTT signal from a controller exceeds the configured time, transmission stops.	.
		d) The NEXCOM System **shall** allow the controller to reinitiate the transmission after Ground Stuck Microphone Correction has disabled the transmission by releasing the PTT command and reapplying it.	.
		Note 1: The NEXCOM System indicates the disabling of the transmission to the controller via the removal of PTT Confirmation.	.

		Note 2: Activation of this function will disable PTT and if preempting, will stop the preemption.	.
3.2.3.8.1	NEXCOM/Telecommunications Interfaces	a) The NEXCOM System telecommunications **shall** provide full-duplex operation.	.
		b) The NEXCOM System **shall** operate with existing 4-wire analog telecommunications and selected digital telecommunications between control and remote radio facilities.	Demonstrate for VG-6 operation and 56kpbs DDC only.
		Note 1: Information on digital telecommunications for NEXCOM will be defined in the NEXCOM/Telecommunications ICD.	.
		Note 2: The following list is representative of services available. Each has a variation for the characteristics of the service type being ordered.	.
		1. Leased Interfacility Communications System (LINCS)	.
		2. FAA Telecommunications Infrastructure (FTI)	.
		3. The FAA Radio Communications Link (RCL)	.
		4. The FAA Low Density Radio Communications Link (LDRCL)	.
		5. The FAA Telecommunications Satellite (FAATSAT) Link	.
		6. The Alaskan NAS Interfacility Communications System (ANICS)	.
		7. Federal Telecommunications System (FTS)–2001 (FTS-2001)	.
		Note 3: The list below is representative of some of the service types offered. Not all the service types listed below are offered by the services listed above.	.
		1. VG-6 voice grade circuits	.
		2. VG-8 voice grade circuits	.
		3. Digital Data Services (DDS)	.
		4. Direct Digital Connectivity (DDC)	.
		5. Fractional T-1 (FT-1) or Nx64 kbps	.

		6. T-1 is T-Carrier at 1.544 Mbps	.
		Note 4: Multiple analog telecommunications circuits may be required to provide sufficient bandwidth to support all four groups of the VDL Mode 3 radio. For example, if only 9600 bps service can be achieved with each available VG-6 circuit, then four or more circuits will be required to support a VDL Mode 3 radio with all of its User Groups active.	.
		c) Analog telecommunications **shall** meet the interface requirements as specified in Telcordia TR-NWT-000335, based on FAA Order 6000.22A.	Demonstrate for VG-6 operation only.
		d) Digital telecommunications **shall** meet the interface requirements specified in Telcordia GR-499-CORE, based on FAA Order 6000.47.	Demonstrate for 56kbps DDC operation only.
		e) The NEXCOM System **shall** support three telecommunication link redundancy configurations:	Demonstration environment provides 2 redundant links. (There maybe multiple lines.)
		1. No backup	.
		3. Hot telecommunications backup	.
		f) The NEXCOM System **shall** only use the bandwidth from 300 Hz to 3000 Hz for analog telecommunication service.	.
		g) The NEXCOM System **shall** be in compliance with 47 CFR Part 68 regarding c) and d) above.	.
		Note 5: Multiple telecommunications circuits may be required to comprise a single telecommunications link. For example, multiple VG-6s may service a single RIU to communicate the different user group information.	.
		Note 6: The hot backup configuration is only applicable when redundant telecommunications are available and the worst-case delay of the links is considered acceptable.	.
		Note 8: VG-8 circuit will not be used for data speeds of less than or equal to 9600bps, unless approved by AOS Branch.	.

3.2.3.8.2.2	Hot Telecommunications Backup Functional Requirements	The following functional requirements are related to NEXCOM service operating with redundant telecommunications while in the hot telecommunications backup configuration.	.
		a) Failure or any performance degradation to either one of the telecommunications interfaces in the hot backup configuration **shall** not degrade the NEXCOM System operation.	.
3.2.4.2	Access	a) Access to MMC functions **shall** be by the following means:	.
		1. Local MMC Access (see SRD Section 3.2.4.2.1)	.
		2. Remote MMC Access (see SRD Section 3.2.4.2.2)	Demonstrate GNI access to MDR only to show that the system passes MDR commands and alerts. This will be demonstrated through the vendor-supplied DST (See Appendix A).
		Note 1: See Figures B-6 and B-6a of SRD Appendix B for local and remote relationships in the NEXCOM MMC System Hierarchy.	.
3.2.4.2.1	Local MMC Access	a) The Local MMC Access **shall** provide on-site authorized personnel access to the MMC functions of directly connected NEXCOM Subsystem(s).	For EDM, demonstrate GNI access only. Authorized personnel is anyone who has access to the EDM. This will be demonstrated using the vendor-supplied DST (See Appendix A).
3.2.4.2.2	Remote MMC Access	a) The Remote MMC Access **shall** provide authorized personnel access to the MMC functions of indirectly connected NEXCOM Subsystems in accordance with SRD Section 3.2.4 a).	For EDM, demonstrate GNI access only. Authorized personnel is anyone who has access to the EDM. This will be demonstrated using the vendor-supplied DST (See Appendix A).
		Note: NIMS is Remote MMC Access.	.

3.2.4.4.1	Monitored Parameter Status	a) The system/subsystem level parameters to be monitored **shall** include the following:	.
		4. Telecommunications Status	.
		5. Subsystem/LRU Status (e.g., Up/Down status for Main/Standby/BUEC elements)	For EDM, demonstrate for MDR only. This will be demonstrated using the vendor-supplied DST (See Appendix A).
		b) Upon restoral of connectivity to a remote device, the NEXCOM System **shall** report as alerts to the appropriate system managers/logs (e.g., MMCWS, NIMS) any configuration changes since the last indication.	.
3.2.4.4.2	Alerting/Alarming	a) System alarms/alerts **shall** be sent automatically to:	.
		1. The local MMC interface	For EDM, demonstration, use MDR to generate alarms/alerts for MDR to GNI. This will be demonstrated using the vendor-supplied DST (See Appendix A).
		2. The remote MMC interface IAW SRD Section 3.2.4 a)	.
		Note: Alarms indicate when the system is performing outside the normal and alert ranges. An alert is indicated when the unit either changes configuration, or the unit is within the alert range.	.
3.2.4.5	System Control Requirements	a) The NEXCOM System **shall** have control functions that allow authorized personnel to adjust designated parameters or exercise designated operational controls for specific subsystems (e.g., Frequency Tuning, VDL Mode 3 System Configuration, and Diversity Site Configuration).	Demonstrate access to MDR controls from GNI. For the EDM the following functions need to be demonstrated: (per MDR Specification, FAA-E-2938:
			1) Log in/Log out (ID=1)
			2) Current Frequency (ID=2)
			3) MDR State (ID=5)
			4) Request Readback (ID=30)

			This needs to be demonstrated through the vendor-supplied DST (See Appendix A).
3.2.4.6.2	Telecommunications Monitoring	a) The NEXCOM Subsystems that interface with telecommunications functions **shall** detect telecommunications (except MDRs analog interface) link failure.	This needs to be demonstrated through the vendor-supplied DST (See Appendix A).
		b) Upon loss of telecommunications service for a site/channel, the affected site/channel **shall** inhibit its RF transmissions automatically.	.
		Note: For sites with redundant telecommunications, all lines for the channel must fail for the RF to be inhibited.	.
3.2.6.1	Common Time Conditioning	a) The NEXCOM System **shall** provide a Timing Source.	.
		b) The NEXCOM System **shall** derive system time from the NEXCOM Timing Source per SRD Section 3.3.6.1.1.	.
		Note 1: System time is applicable to the GNI, RIU and MDR per SRD Section 3.3.6.	.
		c) The NEXCOM Timing Source **shall** accept conditioning from an external Timing Reference.	.
		Note 2: It should be pointed out that the telecommunications service might be capable of providing a timing reference for many sites, or be capable of providing a backup timing reference. Care must be taken to ensure that the sites being synchronized trace to the same timing reference, as efforts are made to place RCAG sites in a different Local Access and Transport Areas from their associated BUEC site.	.
3.2.7.1.1	Single Point of Failure	a) No single failure within the NEXCOM System **shall** cause loss of User Group communications.	.
		Note: This is derived from NAS-SS-1000, Volume I, par. 3.2.4.1.	.

3.2.8	Security Measures	i) The NEXCOM System **shall** authenticate all NEXCOM ground communications.	For EDM, demonstrate for GNI/RIU communications.
		j) The NEXCOM System **shall** provide integrity assurance for the information within NEXCOM.	For EDM, demonstrate for GNI/RIU communications.
		Note 4: See SRD Appendix C for further information on security.	.
3.3.1.1.2.1	Size	a) Each NEXCOM Subsystem **shall** be 19" rack-mountable into standard Electronic Industries Association (EIA - 310) compliant racks.	.
		b) Each NEXCOM LRU **shall** be no more than 18 inches in depth, including connectors.	.
		c) Each NEXCOM Subsystem **shall** be mounted into a rack(s) that is less than or equal to 84 inches tall.	.
3.3.1.1.3	Cable Requirements	a) All NEXCOM cables **shall** meet the performance requirements specified in the following:	.
		1. NFPA Standard 70, National Electrical Code	.
3.3.1.1.5.2	Hazardous Materials	a) The NEXCOM System **shall** be free of asbestos, polychlorinated biphenyls (PCBs), lead, and class 1 ozone depleting substances.	.
		b) The NEXCOM System **shall** limit personnel exposure to hazardous materials to the levels permitted by 29 CFR 1910 Subpart Z.	.
3.3.1.1.5.3	Personnel Safety Requirements	a) The NEXCOM System **shall** comply with the requirements of 29CFR Parts 1910 and 1926.	.
		b) The NEXCOM System **shall** comply with FAA Order 3900.19B.	.
3.3.1.1.5.5	Equipment Safety	a) Connecting cables consistent with proper operation to or disconnecting cables from equipment in the NEXCOM System while the equipment is powered and the system is in operation **shall** not cause damage to any equipment in the NEXCOM System.	.

3.3.1.2.1	Radio Frequency Interference and Electromagnetic Interference Requirements	a) The NEXCOM System **shall** meet the RFI/EMI requirements specified in FAA-G-2100G.	.
3.3.3.1.2.1	Audio Clipping	a) The NEXCOM System **shall** not truncate the voice signal received or transmitted.	.
		Note 1: During Voice Preemption there maybe momentary RF contention between voice transmissions until the mobile transmitter can react to the override signaling.	.
		Note 2: This truncation refers to the nulling of the signal especially at the front end of a transmission.	.
3.3.3.1.3.1	Uplink Path	b) The uplink audio throughput delay **shall** be no greater than 173 ms in digital voice mode.	Performance is generally expressed as latency, i.e., transit time through the NEXCOM system. Telecommunications delays are explicitly not included in the delay times. This comment applies to all requirements labeled 3.3.3.1.3.x
		Note 2: A –12 ms adjustment is made to the total budget due to the fact that vocoder frame 1 is to be modulated 12 ms prior to vocoder frame 6 in the MDR.	.
3.3.3.1.3.2	Downlink Path	b) The downlink audio throughput delay **shall** be no greater than 61 ms in digital voice mode.	.
3.3.3.2.1.3	Subnetwork Integrity	a) The NEXCOM subnetwork **shall** guarantee a probability of undetected packet error of less than 10^{-9}.	.
3.3.3.2.1.4	Subnetwork Transit Delay	a) The NEXCOM System **shall** successfully communicate 95% of the packets from one end of the subnetwork to the other based on the required class of service per SRD Table 3-1.	.
		Note: The requirement means that full prioritization will have to be supported by an efficient scheduler.	.

		Refer to SRD Table 3-1 Class and Delay	.
3.3.3.4.3	Subnetwork Leave Event Issuance Delay	a) The NEXCOM System **shall** issue Leave Events to the A/G Router based on the required class of service 95% of the time per SRD Table 3-3, measured from when the connection is lost to when the Leave Event is sent to the A/G Router. Different performance is specified depending on whether or not data traffic is present.	.
		Refer to SRD Table 3-3 Delay with and without NPDU	.
3.3.3.5	Ground Station Operations	b) Each NEXCOM Talk Group's voice communications resources **shall** be controllable independent from all other Talk Groups' voice communications resources.	.
		c) The NEXCOM System **shall** support operation of multiple ground sites for one User Group in a sector having two to twelve diversely located RCFs.	.
		Note 1: All sites are operating on the same frequency assignment and all using the time slot(s) assigned to the User Group. This includes both voice and data resources depending on the configuration in effect for VDL Mode 3 at the time.	.
		Note 2: The operational configuration stated above refers to the Diversity Site Group operation.	.
		Note 3: In this operation, each site may have unique airspace coverage relative to all other sites but will also have coverage in common with 1 or more other sites.	.
		d) The NEXCOM System **shall** provide uplink M beacons to all Mobile User within a service volume to maintain timing state TS1 as defined in RTCA DO-224A.	.

		Note 4: A 5.76 second interval allows for the worst-case situation where a particular site ceases beacon transmission. Mobile User radios may delay searching for new beacons for up to 5.76 seconds, thus at least one beacon pair from an alternate site will be available before a Mobile User radio enters TS2 (approximately 12 seconds after losing the primary beacon signal). This note is based on voice only operation. For data operation see Note 1 above.	.
3.3.3.6.1	Push-to-Talk Transmitter Keying (PTT/PTT Release)	a) For VDL Mode 3, the NEXCOM System **shall** transmit/cease transmit audio within 175 ms of the arrival of the PTT/PTT Release signal at the NEXCOM/VSCE interface for 99.9% of the events.	Performance is generally expressed as latency, i.e., transit time through the NEXCOM system. Telecommunications delays are explicitly not included in the delay times. This comment applies to all requirements labeled 3.3.3.6.x
3.3.3.6.2	PTT/PTT Release Confirmation	b) The NEXCOM System **shall** indicate to the NEXCOM/VSCE interface the confirmation of audio transmission within 350 ms for 99.9% of the PTT/PTT Release confirmation events.	.
3.3.3.6.3	Preemption of Mobile Users' Voice Transmissions (Controller Override)	a) The NEXCOM System **shall** initiate transmission of a VDL Mode 3 Voice Preemption signal in the next two scheduled uplink M-burst opportunities for the associated primary and backup radio sites when the condition of simultaneous presence of a Voice Preemption control signal and a PTT control signal occurs at the NEXCOM/VSCE interface.	.
		Note 1: The Voice Preemption should be transmitted in the first available uplink M-burst for the primary and its associated backup radio sites, if possible.	.
		b) The Voice Preemption signal **shall** be contained in the next scheduled uplink Beacon that occurs at least 50 ms after the reception of the Voice Preemption and PTT signals from the NEXCOM/VSCE interface for 99.9% of the preemption events.	.

		Note 2: For diversity site group operation, the scheduled uplink M-bursts will rotate around the various ground stations in the diversity site group to ensure all Mobile User in the coverage area will receive a Voice Preemption signal.	.
		c) When configured for diversity site group operation and during an attempted Voice Preemption, the NEXCOM System **shall** disable current downlink transmissions with the next uplink M-burst opportunity.	.
		Note 3: This requirement implies that the ground station will change whatever rotation of uplink M-bursts so that the ground station (pair) from which the Mobile User currently is receiving timing will send the next uplink M-burst(s). It may be desirable that the next ground station (pair) be the ground station selected for voice transmission.	.
		Note 4: The timeliness of the Voice Preemption is considered of equal importance to that of the PTT signal.	.
3.3.3.6.4	Preemption Confirmation of Mobile Users' Voice Transmissions	a) The NEXCOM System **shall** provide, back to the NEXCOM/VSCE interface, confirmation of Voice Preemption activation within 350 ms of its transmission for 99.9% of the events.	.
		Note: The timeliness of the Voice Preemption indication is considered of equal importance to that of the PTT confirmation.	.
3.3.3.6.5	Squelch Break	a) The NEXCOM System **shall** indicate to the NEXCOM/VSCE interface squelch breaks in the receiver within 100 ms for 99.9% of the squelch break indication events.	.
		Note 1: Squelch break is a continuous indicator with an overall latency of up to 350 ms.	.
		Note 2: The timeliness of the squelch break indication is considered of equal importance to that of the Channel Busy signal, as some regions use this signal to route audio.	.

3.3.3.6.7.1	Ground Radio Resource Selection	a) The NEXCOM System **shall** select radio resources (e.g., Main/Standby Select/Deselect, or BUEC Select/Reset as necessary) within 100 ms of receipt of the signal from the NEXCOM/VSCE interface for 99.9% of the Ground Radio Resource Selection events.	Demonstrate RCAG / BUEC only.
3.3.3.6.7.2	Ground Radio Resource Selection Confirmation	a) The NEXCOM System **shall** confirm Ground Radio Resource Selection (e.g., Main/Standby Select/Deselect, or BUEC Select/Reset as necessary) within at most 250 ms from the time of switching for 99.9% of the Ground Radio Selection events.	.
		Note: The radio resource selection confirmation has an overall latency of up to 425 ms from generation to display at the controller.	.
3.3.3.6.8	Channel Busy Signal Performance	The Channel Busy signal is an indicator to the controller that a channel is not available. It is an indicator that is a feedback to a controller action, and it is a factor in the operational suitability of the system. An overall latency of 300 ms appears suitable, of which 125 ms can be allocated to the NEXCOM System.	.
		a) The NEXCOM latency for the Channel Busy indicator **shall** be at most 125 ms for 99.9% of the channel busy events.	.
3.3.3.7	Ground Stuck Microphone Correction	a) The Ground Stuck Microphone timeout **shall** be configurable to be enabled or disabled.	.
		b) The Ground Stuck Microphone timeout, when enabled, **shall** be configurable from 5 seconds to 5 minutes in 5 second increments.	Demonstrate GNI/RIU capabilities for VDL Mode3. Demonstrate in the enabled configurations for one time setting. Use the vendor-supplied DST (See Appendix A) (See also 3.2.3.7).
3.3.3.8.1	Telecommunications Delay and Delay Variations	a) The NEXCOM System **shall** operate when the telecommunications one-way delay is up to 600 ms.	.

		Note 1: It is desirable to limit one-way transfer delay to a minimum and below 25 ms. There are, however, circumstances that longer-delay telecommunication links, e.g., satellite links, are the only viable alternatives. The worst-case delay scenario defined for the NEXCOM System is for a double satellite hop link with a maximum transfer delay of 600 ms (as defined by ANICS).	.
		b) The NEXCOM System **shall** operate with transfer delay variations.	.
		Note 2: Variations may be due to line switching, packet path variations, or clock slips.	.
		Note 3: The extent of the variation will be addressed in future documentation.	.
3.3.3.8.2	Telecommunications Restoration Performance	The following are performance requirements associated with telecommunications restoration:	.
		b) For telecommunications service interruption of less than 1 second in duration, the NEXCOM System **shall** restore the communications service within 120 ms after the condition that caused the service interruption is removed.	.
3.3.4.1.2	Non-Interference MMC	a) The NEXCOM MMC function **shall** not degrade system performance unless a commanded self-test, supported in SRD Section 3.2.4.6.1 h), requires that the NEXCOM System temporarily prohibit operational use for the thread(s) under test.	The EDM does not have a commanded self-test.
		Note: The NEXCOM MMC function should not impact the performance of a thread under any condition, but an exclusion is made to allow the NEXCOM System to enter a more comprehensive testing state where the operation, exclusive to the thread(s) under test, may or may not be impacted depending on the design and the confidence level associated with the test.	.

3.3.4.5.1	Frequency Range	a) The NEXCOM System **shall** provide communications services in the range of 112 -137 MHz.	.
		Note: It is anticipated that the NEXCOM System will operate initially on the 118 – 136.975 MHz assigned channels.	.
3.3.4.5.2	RF Power Output	a) The RF output power of the NEXCOM System **shall** be adjustable from 2 to 50 watts (33 dBm to 47 dBm).	.
		Note: The RF power range applies to all NEXCOM System modes.	.
3.3.5.1.1.2	NEXCOM System Throughput	b) The NEXCOM System **shall** operate with full occupancy of all voice and data slots.	.
3.3.6.1.1	Timing Accuracy	a) When the NEXCOM System is operating in VDL Mode 3 under normal operating conditions, the RF transmissions emanating from the NEXCOM System **shall** not be more than ±23.55 □s from their scheduled event time with respect to the Timing Standard specified in SRD Section 3.3.6.3.	.
		b) When the NEXCOM System is operating in VDL Mode 3 with loss of the Timing Reference, the RF transmissions emanating from the NEXCOM System **shall** not be more than ±190 ms from their scheduled event time with respect to the Timing Standard specified in SRD Section 3.3.6.3 and the Timing Drift period specified in SRD Section 3.3.6.2.	.
		Note: See SRD Appendix G for an explanation of the timing synchronization requirements.	.
3.4.2.1.1	RIU Physical Layer Functions	a) The RIU **shall** encode and decode Reed-Solomon (72, 62) codewords for VDL Mode 3 data burst operation per RTCA DO-224A, Section 3.3.1.3.3.3.	.
3.4.2.1.2	RIU Media Access Control (MAC) Functions	a) The RIU **shall** implement the ground portion of the VDL Mode 3 MAC sublayer for voice, data and management functions as defined in RTCA DO-224A Section 3.3.2.1, except for requirements related to system configurations 3T, 3S and 2S1X.	Demonstrate for 2V2D only.

		Note: System configurations 3T, 3S and 2S1X are exempted from the initial implementation, but provide them as an upgrade capability.	.
3.4.2.1.3	RIU Subsystem VDL Mode 3 DLS Functions	a) The RIU **shall** provide the DLS acknowledgment (ACK) processing and priority queuing functions as defined in RTCA DO-224A, Section 3.3.2.2.	.
		b) The RIU **shall** perform error detection and address identification (ID) on all DLS frames received from an MDR receiver as defined in RTCA DO-224A, Section 3.3.2.2.1.	.
3.4.2.1.4	RIU Link Management Entity (LME) Functions	a) The RIU **shall** provide the following LME functions as defined in RTCA DO-224A, Section 3.3.2.3, for all VDL Mode 3 system configuration except 3T, 3S, and 2S1X:	.
		1. Net Initialization	.
		2. Net Entry	.
		3. Link Maintenance (e.g., polling)	.
		4. Link Release	.
		5. Expedited Recovery	.
		Note: System configurations 3T, 3S, and 2S1X are exempted to simplify the initial implementation, yet provide them as an upgrade capability.	.
3.4.2.2.1.1.2	RIU Subsystem Vocoder Operation	b) The RIU **shall** support both normal voice and downlink truncated voice data rates.	.
		Note 2: This requirement is to ensure that the ground station can provide received truncated voice to the controller in cases where the Mobile User comes into coverage in the middle of a voice transmission.	.
3.4.2.2.1.2.1	RIU Subsystem VDL Mode 3 Data Operation	a)For VDL Mode 3 data operation, the RIU **shall** schedule data access per the Manual for the Implementation of VDL Mode 3, Section 4.9.	.

		Note 1: For diversity site group operations with respect to Section 4.9 of the referenced Manual, voice preemption signaling will also contend for M uplink channel resources and may complicate scheduling.	.
3.4.2.3.2	RIU Telecommunications Monitoring	a) The RIU **shall** inhibit RF transmissions upon detection of the loss of telecommunications service.	.
		Note: For dual control operation, this requires the loss of both control site connections.	.
3.4.2.4	RIU Subsystem Interfaces	a) The RIU **shall** have the following interfaces:	.
		2. RIU/MDR Digital Interface (see SRD Section 3.4.2.4.7)	.
		4. RIU/Timing Source Interface (see Note)	.
		5. RIU/Telecommunications Link Interface to GNI (see SRD Section 3.4.2.4.1)	.
		Note: The RIU/Time source interface may be internal to the RIU.	.
3.4.2.4.1	RIU/Telecommunications Interfaces	a) The RIU **shall** interface with at least a 56 kbps digital service via a DDC interface to access the remote GNI.	.
		b) The RIU **shall** support usage of analog 4-wire VG-6 ground telecommunications circuits to access the remote GNI when the digital interface is not being used.	.
		f) When configured for hot telecommunications backup with a GNI, the RIU **shall** simultaneously communicate over the redundant telecommunications interfaces with that GNI.	.
		g) When configured for hot telecommunications backup with a GNI, the RIU **shall** be able to use information from either interface without interfering with the operation of the communications system.	.
3.4.2.4.7	RIU/MDR Digital Interfaces	a) An RIU **shall** support up to two MDR transmitters and two MDR receivers.	Demonstrate for one each TX and RX.

3.4.2.5	Signaling	b) The RIU **shall** be configurable to either pass through an MDR generated PTT/PTT Release Confirmation signal or generated the signal locally per c).	PTT/PTT Release Confirmation limited to MDR generated signal.
		d) The RIU **shall** use the End of Message (EOM) bit or lack of voice messages to indicate squelch break inactive, while operating in VDL Mode 3.	.
3.4.2.7	RIU Site Configuration	a) The RIU **shall** support a configuration with a common RIU supporting the transmitters and receivers associated with a User Group.	.
3.4.2.8	RIU System Timing Source	a) The RIU **shall** provide timing to the MDR transmitters and receivers.	.
		Note 1: This timing is to allow for intersite synchronization to prevent interslot interference.	.
		b) The RIU **shall** provide timing to the GNI.	.
		Note 2: This timing is to allow the GNI vocoders to track the VDL Mode 3 timing to minimize end-end voice delay.	.
3.4.3.2.1	Air/Ground Voice and Data	a) The GNI **shall** multiplex voice and data for transmission to the appropriate ground station RIU.	.
3.4.3.2.1.1	GNI Subsystem Voice Operation	When supporting voice operations, the following apply:	.
		a) The GNI **shall** encode/decode speech using the vocoder specified in ICAO Annex 10, Vol. III, Part 1, Chapter 6 for each Talk Group.	.
3.4.3.2.1.2.1	VDL Mode 3 Data Operation	b) The GNI **shall** provide CLNP frame mode compression, as requested by Mobile Users, as defined in RTCA DO-224A, Section 3.3.3, and Appendix K.	.
		c) The GNI **shall** provide raw subnetwork interface data transfer services for non-ATN messaging, as defined in RTCA DO-224A, Section 3.3.3.	.

		e) The GNI **shall** provide CLNP data transfer services, as requested by Mobile Users, as defined in RTCA DO-224A, Section 3.3.3.	.
3.4.3.3.1	GNI Subsystem Remote Monitoring Functions	c) The GNI **shall** monitor the functional status of its associated MDRs.	This will be demonstrated through the vendor-supplied DST (See Appendix A).
3.4.3.3.2	GNI Subsystem Remote Control Functions	b) The GNI **shall** support remote control of its associated MDRs.	This will be demonstrated through the vendor-supplied DST (See Appendix A).
		d) The GNI **shall** coordinate operation of primary and backup site radio strings for a given User Group.	.
		Note: This includes coordination of the data protocol states between the sites and Beaconing control.	.
3.4.3.4.1	GNI/Telecommunications Interfaces	a) The GNI **shall** interface with at least a 56 kbps digital service via a DDC interface to access the remote RIU.	.
		b) The GNI **shall** support usage of analog 4-wire VG-6 ground telecommunications circuits to access the remote RIU, when the digital interface is not being used.	.
		d) The GNI **shall** support redundant telecommunications interfaces for each RIU per SRD Section 3.2.3.8.1 e).	Demonstrate 3.2.3.8.1 e) 1. and 3. only.
		Note 1: The telecommunications interfaces may be on dissimilar media.	.
		f) When configured for hot telecommunications backup with an RIU, the GNI **shall** simultaneously communicate over the redundant telecommunications interfaces with that RIU.	.
		g) When configured for hot telecommunications backup with an RIU, the GNI **shall** be able to use information from either interface without interfering with the operation of the communications system.	.
3.4.3.4.2	GNI/RIU Interfaces	a) The GNI **shall** interface with RIUs via the GNI/Telecommunications interface.	.

		Note 1: This includes the capability for Local Radios, where RIUs will be required.	.
		b) The GNI **shall** be scalable in the number of RIUs that may be supported.	.
3.4.3.4.6	GNI/VSCE Interfaces	a) The GNI **shall** interface with existing VSCE (e.g., VSCS, ETVS, ICSS, RDVS, STVS) via existing interfaces (e.g., Single channel (V+U) and quad channel (V/U/M/S)).	Demonstrate for VSCS Type B (GRIM) and BUEC VHF interfaces only, per NAS-IR-XXXXXXXX.
3.4.3.4.7	GNI/Router Interfaces	a) A GNI **shall** interface with an A/G Router via a GNI Data Switch function, per SRD Appendix B.4.	For EDM, interface with router directly ACT 330-ID-0001. No data switching function need be demonstrated.
		Note 1: GNIs may share the data switch function to interface with the A/G Router.	.
3.4.3.4.9	GNI/Automation Interfaces	a) The GNI **shall** interface with the automation system to receive Next Channel Uplink information.	Demonstrate Next Channel uplink function. Trigger for this function to be supplied with the EDM. This also requires some type of indication that signal has been received. The vendor-supplied DST will be used (as means to display indications) to demonstrate this capability.
		b) The GNI **shall** receive confirmation from the radio site as to the success of the uplink of the Next Channel Uplink information.	.
		c) The GNI **shall** present to the automation system the confirmation signal on success of the Next Channel Uplink transmission.	.
		d) The GNI **shall** provide indication to the automation system of the login status of the Mobile User.	.
		f) The GNI **shall** provide indication to the automation system of received Urgent Downlink Requests for VDL Mode 3.	.

3.4.3.5	Signaling	b) The GNI **shall** pass the signaling from the RIU to the VSCE as indicated in SRD Section 3.4.2.5 b), d), and g).	Demonstrate 3.4.2.5 b) and d) only using the vendor-supplied DST (See Appendix A).
		Note: The Automation interface may introduce additional signaling to support its functions.	.
3.4.3.6.1	GNI Redundancy	a) The failure of any thread(s) within the GNI to its RIU **shall** not degrade communications of any other GNI/RIU threads.	.
		b) A failure within a GNI **shall** not cause loss of communications within a User Group.	.
		c) Failure of a single GNI thread **shall** not cause loss of A/G communications services.	.
3.4.7.1	Time Conditioning	a) The Timing Source **shall** synchronize timing with the Timing Reference.	.
		b) The Timing Source **shall** provide timing to connected RIU(s).	.
3.4.7.2	Timing Source Interfaces	a) The Timing Source **shall** interface with the Timing Reference.	.
3.5.2.2.1.2.1	RIU/GNI Message Delays	a) The RIU **shall** complete the transmission of a valid DLS frame over the RIU/GNI telecommunications link no later than 500 ms after the last data burst message associated with the DLS frame is received from the MDR Receiver.	EDM validate transmission time required between RIU and GNI using.
		b) The RIU **shall** provide timing signals to the GNI to minimize end-end voice delay.	.
3.5.2.4.1.1	Transmission Path Failure Restoration	b) For telecommunications service interruption of less than 1 second in duration, the RIU **shall** restore communications to the GNI within 120 ms.	.
3.5.2.5.1	RIU Signaling Integrity	a) The RIU **shall** ensure that no more than one control signal in one million is falsely interpreted or not completed.	.
3.5.3.2.1.2.1	GNI Data Processing Delay	a) The processing delay for multiplexing VDL Mode 3 voice and data of a GNI subsystem **shall** be less than 10 ms.	.
		b) MMC data processing **shall** not delay uplink or downlink voice and control data processing or distribution.	.

3.5.3.4.1.1	Transmission Path Failure Restoration	b) For telecommunications service interruption of less than 1 second in duration, the GNI **shall** restore communications to the RIU within 120 ms.	.
3.5.3.5.1	GNI Signaling Integrity	a) The GNI **shall** ensure that no more than one control signal in one million is falsely interpreted or not completed.	.
3.5.3.5.2.1	PTT/PTT Release	c) The response time from the instant the GNI receives a PTT/PTT Release signal from the VSCE, to the instant the RIU provides/removes VDL Mode 3 voice packets at the RIU/MDR interface **shall** not exceed 165 ms for 99.9% of the events.	.
3.5.3.5.2.2	PTT/PTT Release Confirmation	c) The response time from the instant the RIU provides/removes the VDL Mode 3 voice bursts at the RIU/MDR interface, to the instant that the GNI provides a PTT/PTT Release Confirmation signal at the NEXCOM/VSCE interface **shall** not exceed 340 ms for 99.9% of the events.	.
3.5.3.5.2.3	Preemption of Mobile Users' Voice Transmission	a) The Voice Preemption signal **shall** be contained in the next scheduled uplink Beacon that occurs at least 50 ms after the reception of the Voice Preemption and PTT signals from the NEXCOM/VSCE interface for 99.9% of the preemption events.	.
3.5.3.5.2.4	Preemption Confirmation of Mobile Users' Voice Transmissions	a) The response time from the instant the Voice Preemption signal is generated at the RIU to the instant when the Voice Preemption Confirmation signal is received at the NEXCOM/VSCE interface **shall** not exceed 340ms for 99.9% of the events.	.
3.5.3.5.2.5	Squelch Break	b) The response time from the instant the MDR provides/removes voice bursts at the RIU/MDR interface, to the instant that the GNI provides a Squelch Break indication at the NEXCOM/VSCE interface **shall** not exceed 100 ms for 99.9% of the events.	.

4.0 METHODS OF VERIFICATION

The following four verification methods are generally utilized in determining compliance of individual requirements contained in FAA purchase descriptions: TEST, DEMONSTRATION, ANALYSIS, and INSPECTION. They are listed below in decreasing order of complexity, and are described as follows:

1. TEST. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, items, and services.
2. DEMONSTRATION. Demonstration is a method of verification where qualitative determination of properties is made for an end item, including the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.
3. ANALYSIS. Analysis is a method of verification that consists of comparing hardware design with known scientific and technical principles, procedures and practices to estimate the capability of the proposed design to meet the mission and system requirements.
4. INSPECTION. Inspection is a method of verification to determine compliance without the use of special laboratory appliances, procedures, or services, and consists of a non-destructive static-state examination of the hardware, the technical data and documentation.

For the EDM DEMONSTRATION (as defined in 2 above) is to be used wherever possible. For requirements where a demonstration is not feasible, ANALYSIS needs to be performed. Where critical performance parameters need to be verified, TESTING can be performed. Testing is to be held to a minimum.

5.0 PREPARATION FOR DELIVERY

The EDM equipment will be delivered in accordance with Section F of the contract/SOW.

6.0 NOTES

6.1 Abbreviations and Acronyms

A list of abbreviations and acronyms may be found in Appendix B.

APPENDIX A

Demonstration Support Tool

A.1.0 DEMO SUPPORT TOOL

The Demonstration Support Tool (DST) will provide the means to demonstrate specific EDM signaling and functionality required to validate the EDM demonstration. The DST will provide the signaling and functionality that will not be instantiated by the FAA equipment (VSCS and Automation). The DST will be developed by the vendor. The interface, which is required to connect the DST to the EDM's GNI, will also be developed by the vendor. Figure A-1 depicts an interaction that will exist between the GNI and DST as well as an interaction that will exist between the VSCS and GNI. For the EDM, the GNI/VSCS interface requirements have been specified in the GNI NAS-IR-xxxxxxxx.

The vendor demonstration will need to show how each of the functional and performance requirements in the MTD are meet. FAA equipment will be used to demonstrate part of the functional requirements with its human interface. The DST will demonstrate the remainder with its human interface. The human interface is left to the vendor to develop, but it will have to address the demonstration of the functional requirements. The performance requirements will need to be demonstrated by the vendor using appropriate equipment that shows compliance to these requirements.

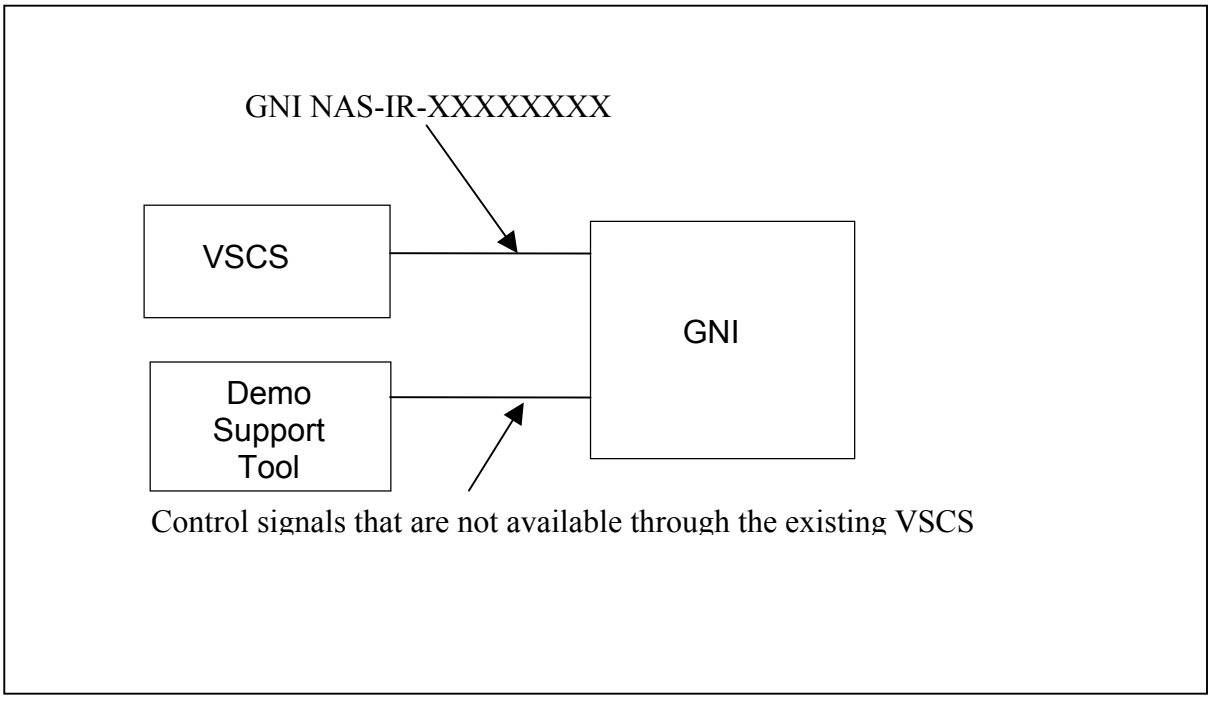

Figure A-1

Demonstration Support Tool

A.2.0 MTD FUNCTIONAL REQUIREMENTS (MTR)

The functions that are associated with the MDR will conform to FAA-E-2938 and NAS-IC-41033502. The following is a listing of the functions (SRD Section numbers and titles) that the DST will need to ensure are fulfilled:

a) 3.2.3.4.2 Automated Transfer of Communication
   1) The DST will need to demonstrate the Next Net messaging.
b) 3.2.3.6.2 PTT/PTT Release Confirmation
   1) The DST will need to demonstrate the PTT confirmation signaling.
c) 3.2.3.6.3 Preemption of Mobile Users' Voice Transmissions (Controller Override)
   1) The DST will need to demonstrate the preemption of the mobile users' voice transmission.
d) 3.2.3.6.4 Preemption Confirmation of Mobile Users' Voice Transmissions
e) 3.2.3.6.5 Squelch Break (BUEC Interface Only)
f) 3.2.3.6.8 Channel Busy Signal
g) 3.2.3.7 Ground Stuck Microphone Correction
   1) The DST will need to demonstrate the ability to enable and disable this function.
h) 3.2.4.2 Access
   1) The DST will demonstrate GNI access to MDR only to show that the system passes MDR commands and alerts.
i) 3.2.4.2.1 Local MMC Access
   1) The DST will demonstrate local GNI access only.
j) 3.2.4.2.2 Remote MMC Access
   1) The DST will demonstrate remote access to the MDR through the GNI.
k) 3.2.4.4.1 Monitored Parameter Status
   1) The DST will demonstrate the status of the remote MDR through the GNI.
l) 3.2.4.4.2 Alerting/Alarming
   1) The DST will demonstrate the alerting/alarming of the remote MDR through the GNI.
m) 3.2.4.5 System Control Requirements
   1) The DST will demonstrate control of the MDR through the GNI for the following parameters:
      a) Log-In/Log-Out (ID=1)
      b) Current Frequency (ID=2)
      c) MDR State (ID=5)
      d) Request Read Back (ID=30)
n) 3.2.4.6.2 Telecommunications Monitoring
   1) The DST will demonstrate the detection of a telecommunications failure.
o) 3.4.3.3.1 GNI Subsystem Remote Monitoring Functions
   1) The DST will need to demonstrate the ability to monitor MDR functions.
p) 3.4.3.3.2 GNI Subsystem Remote Control Functions
   1) The DST will need to demonstrate the ability to control MDR functions
q) 3.4.3.4.9 GNI/Automation Interfaces (Next Net/Next Net Confirmation/Mobile User ID/Urgent Downlink Request)
r) 3.4.3.5 Signaling (PTT Confirmation/ Squelch Break (BUEC Interface Only))

APPENDIX B

Abbreviations and Acronyms

B.1 Abbreviations and Acronyms

A/G	Air/Ground
ACK	Acknowledge
ANICS	Alaskan NAS Interfacility Communications System
ANSI	American National Standards Institute
AOS	FAA Operational Support Services
ATN	Aeronautical Telecommunication Network
BUEC	Backup Emergency Communications
CFR	Code of Federal Regulations
CPDLC	Controller Pilot Data Link Communications
DDC	Direct Digital Connectivity
DDS	Digital Data Services
DLAP	Data Link Applications Processor
DLS	Data Link Service or Data Link Sub layer
DOT	Department of Transportation
EDM	Engineering Design Model
EIA	Electronic Industries Alliance
EMI	Electromagnetic Interference
EST	Eastern Standard Time
ETVS	Enhanced Terminal Voice Switch
FAA	Federal Aviation Administration
FAATSAT	FAA Telecommunications Satellite
FCC	Federal Communications Commission
FSDP	Full Scale Development Program (FSDP)
FT-1	Fractional T-1 or Nx64 kbps
FTI	FAA Telecommunications Infrastructure
FTS	Federal Telephone System
G/G	Ground to/from Ground
GFE	Government Furnished Equipment
GNI	Ground Network Interface
Hz	Hertz
HID	Host Interface Device
HW	Hardware
ICAO	International Civil Aviation Organization

ICD	Interface Control Document
ICSS	Integrated Communication Switching System
ID	Identification
ISO	International Organization for Standardization
IRD	Interface Requirements Document
kHz	kilohertz
LAN	Local Area Network
LDRCL	Low Density Radio Control Link
LINCS	Leased Interfacility Communications System
LME	Link Management Entity
LRU	Lowest Replaceable Unit
M/S	Main/Standby
MAC	Media Access Control
MASPS	Minimum Aviation System Performance Standards
MDR	Multimode Digital Radio
MDT	Maintenance Data Terminal
MHz	Megahertz
MMC	Maintenance, Monitoring, and Control
MMCWS	Maintenance Monitoring and Control Work Station
MOPS	Minimum Operational Performance Standards
ms	millisecond
MTD	Minimum Threshold Document
MTR	Minimum Threshold Requirement
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NEXCOM	Next Generation Air/Ground Communications
NFPA	National Fire Prevention Association
NIMS	NAS Infrastructure Management System
NPDU	Network Protocol Data Unit
PCB	Polychlorinated Bi-Phenol
PTT	Push-to-Talk
RCAG	Remote Center Air/Ground Facility
RCF	Remote Communications Facility
RCL	Radio Communications Link
RDVS	Rapid Deployment Voice Switch
RF	Radio Frequency
RFI	Radio Frequency Interference
RFO	Request for Offer
RIU	Radio Interface Unit
RMA	Reliability, Maintainability, and Availability
RMM	Remote Maintenance Monitoring

RMMC	Remote Maintenance Monitoring and Control
RMMS	Remote Maintenance Monitoring System
RPDE	Rapid Preliminary Development Effort
RTCA	RTCA, Inc. (formerly Radio Technical Commission for Aeronautics)
Rx	Receiver
SARPs	Standards and Recommended Practices
SIR	Screening Information Request
SOW	Statement of Work
SRD	System Requirements Document
SSS	Subsystem Specification
STVS	Small Tower Voice Switch
SW	Software
T-1	T-Carrier at 1.544 Mbps
Tx/Rx	Transmit/Receive or Transmitter/Receiver
TCD	Test Capabilities Document
TDMA	Time Division Multiple Access
Telco	Telephone Company
TS1	Timing State 1
TS2	Timing State 2
TSGR	Transport Systems Generic Requirements
Tx	Transmit
UHF	Ultra High Frequency
V + U	VHF + UHF
VDL	VHF Digital Link
VG-6	Voice Grade 6 Circuits
VG-8	Voice Grade 8 Circuits
V/U/M/S	VHF/UHF/MAIN/STANDBY
VHF	Very High Frequency
VSCE	Voice Switching and Control Equipment
VSCS	Voice Switching and Control System
WAN	Wide Area Network
WJHTC	William J. Hughes Technical Center